Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2046711 C 2002/04/09

(11)(21) 2 046 711

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1991/07/10

(41) Mise à la disp. pub./Open to Public Insp.: 1992/01/11

(45) Date de délivrance/Issue Date: 2002/04/09

(30) Priorité/Priority: 1990/07/10 (P 40 21 908.9) DE

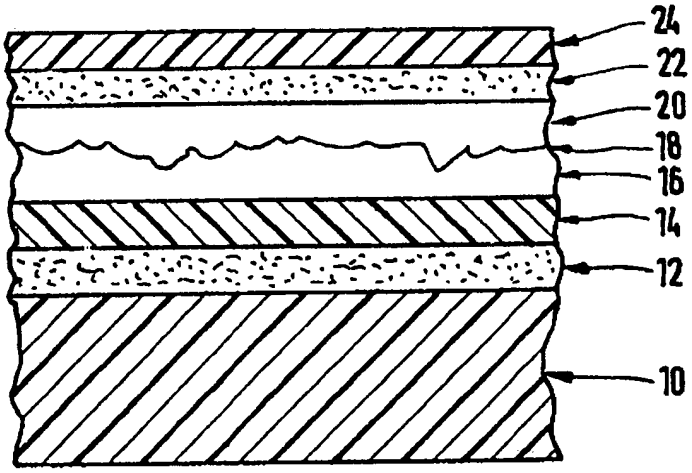
(51) Cl.Int.^{5}/Int.Cl.^{5} G03H 1/18

(72) Inventeur/Inventor:
Kaule, Wittich, DE

(73) Propriétaire/Owner:
GAO Gesellschaft fur Automation und Organisation MBH, DE

(74) Agent: RICHES, MCKENZIE & HERBERT LLP

(54) Titre : ELEMENT MULTICOUCHE A EFFETS OPTIQUES VARIABLES
(54) Title: MULTILAYER OPTICALLY VARIABLE ELEMENT



(57) Abrégé/Abstract:
In a multilayer optically variable element, preferably a hologram, comprising an adhesive layer covered by an easily removable cover layer, and at least one layer having the optically variable effect, the protective layer is designed as a self-supporting and dimensionally stable layer with a thickness of a few micrometers.

Abstract

In a multilayer optically variable element, preferably a hologram, comprising an adhesive layer covered by an easily removable cover layer, and at least one layer having the optically variable effect, the protective layer is designed as a self-supporting and dimensionally stable layer with a thickness of a few micrometers.

A multilayer optically variable element

The present invention relates to a multilayer optically variable element, preferably a hologram. It also relates to a substrate equipped with the optically variable element and to a method for producing the optically variable element.

Optically variable elements are primarily understood to be holograms and diffraction grids, but they may also be other elements having an optically visible effect that changes in accordance with the viewing angle and/or irradiated wavelength due to characteristic interference effects, reflection, transmission, absorption and other properties.

Holograms are customarily produced in the form of sheet-like labels and transferred to the desired substrate, such as paper, plastic, textile material or the like, by means of a contact adhesive or a hot embossing transfer technique. It is also known to emboss holograms directly into layers of lacquer disposed on the substrate. The holograms are hardened after embossing by exposure to UV light or electron beams.

Holograms are increasingly used as authenticity features for protecting papers of value and cards employed in cashless money transfer. Such holograms must firstly be tamper-resistant, i.e. virtually undetachable from the carrier. Furthermore, they must withstand considerable mechanical stresses over a long time without showing any noticeable changes.

Holograms consisting of plastic films affixed to a substrate with a contact adhesive have relatively high stability, i.e. they are most suitable for withstanding the mechanical stresses that arise. A disadvantage, however, is their thickness and the resulting rigidity, that makes it impossible to employ such adhesive labels for protecting bank notes, for example.

Holograms that are embossed into a thin layer of lacquer disposed on the substrate can be used in many ways, for example in bank notes due to their small thickness. However, the layer of lacquer is very sensitive to mechanical and chemical stresses. They are therefore unsuitable for protecting papers of value and cards which are used daily for some time.

German laid open patent application publication DE-OS 33 08 831 published on May 10,1984 discloses a hologram that can be applied to a substrate by the transfer method. To permit better handling of the relatively thin hologram it is connected by a separation layer with a relatively stable carrier film that can be removed after the hologram has been applied to the substrate. This technique permits the application of relatively thin-layer holograms that can hardly be handled as such due to their low dimensional stability and rigidity. This property is utilized to rule out a subsequent detachment of the hologram for purposes of manipulation. On the other hand, the hologram can be machined together with the carrier film, for example, brought together with a substrate in a roll slit.

The known hologram has on its side facing away from the carrier film a hot-melt adhesive layer permitting labels to be transferred to a substrate, their contour corresponding exactly to the contour of a heated die with which the compound material is pressed against the substrate. After the carrier layer is detached the known hologram is protected by a thermoplastic transparent layer that has no dimensional stability and is not self-supporting so as to prevent detachment. This thermoplastic protective layer does not impede the transfer to the substrate in any way since it tears in the edge area of the heated transfer die when the carrier film is removed after the hologram has been pressed onto the substrate, thus also permitting easy detachment of those areas which are not loaded by the transfer die. However, it must be regarded as a serious disadvantage that this thermoplastic protective layer is relatively soft and unresistant. A hologram protected with such a layer does not withstand mechani-

cal and chemical environmental influences for any length of time.

The present invention is based on the problem of providing an optically variable element that has minimal thickness while being maximally resistant to environmental influences, i.e. to abrasion, crumpling, soiling, washing, chemicals, etc., and that is easy to produce, on the one hand, while being transferable to a substrate without difficulty by means of a transfer method, on the other hand.

This problem is solved according to the invention which resides in providing multilayer optically variable element having an adhesive layer (22), at least one layer (16, 18, 20) having the optically variable effect, at least one protective layer (14) and a removable carrier layer (10), characterized in that the protective layer (14) is designed as a self-supporting and dimensionally stable layer having a thickness of from a few micrometers to about 20 μ.

The invention is based on the finding that the hologram can in fact be mechanically unstable for security reasons but the protective layer of the hologram must not be an unstable, non-self-supporting film but rather a layer that withstands mechanical loads to a maximal degree despite its small thickness. A particularly suitable film has proven to be one made of PC, PVF, PETP, PCTFE or FEP with a thickness of from a few micrometers to about 20 μ, in particular in the range of 10 μ. Since such thin films cannot be handled by machines the film compound is combined, in the basically known way, with a carrier film that is removed after the hologram has been applied to the substrate.

When holograms are applied the contour of the particular plane element is prepunched in the thin protective film, so that it is readily possible to detach or extract the hologram from the surrounding material.

Replacing the known unstable layer by an equally thin but extremely resistant film, for example of polycarbonate (PC), polyvinyl fluoride (PVF), polyethylene terephthalate (PETP), polychlorotrifluoroethylene (PCTFE), tetrafluoroethylene/ hexafluoropropylene copolymer (FEP), together with the measure of prepunching the hologram contours, results in a holo-

gram that combines in an unprecedented way the advantages of particularly small thickness with the advantages of excellent mechanical durability. With consideration of possible security aspects the layer supporting the hologram should be dimensioned without any great inherent strength, while the protective film should be selected in terms of thickness and material properties such that when applied to the substrate it can sufficiently protect the hologram layer from mechanical and other loads, on the one hand, but is dimensioned such that subsequent detachment leads at least to an irreversible deformation or destruction, on the other hand. A protective film of PC, PVF, PETP, PCTFE or FEP, in a thickness of about 3 to 20 μ, in particular in the range of 10 μ, meets these basically contradictory demands excellently. If sufficiently viscous plastics material is used, a layer thickness of about 1 μ is even possible. Furthermore, such a hologram can be applied to a substrate either as an adhesive label or by known heat-sealing techniques. If protection from forgery is of less interest the embossed structure can also be incorporated directly into the protective layer. In this case the further hologram layer can be omitted.

Instead of an embossed hologram one can of course also use other layers with optically variable effects, for example a photographic emulsion layer with a volume hologram, a diffraction grid or a layer with interference or color change effects.

To fabricate the compound film material the material is most simply cut into strips and rolled up. These strips or threads are preferably applied to an continuously supplied substrate in a calender-like roller frame.

For label-like holograms of any desired contour the basically known decal technique is applied, i.e. the label contour is prepunched into the thin protective film so that the label sticks to the substrate when the carrier film is removed.

Due to their mechanical stability under load and their small thickness, the inventive holograms are particularly suitable for equipping papers of value such as bank notes. Furthermore, the easy handling and inexpensive production of the transfer material are of great importance.

In the following some embodiment examples of the invention shall be described by way of example with reference to the adjoined drawing, in which:

Figs. 1a to c show various production steps for the transfer material,

Fig. 2 shows schematically the production of the transfer material of Fig. 1a, and

Fig. 3 shows schematically the application of a hologram to an endless paper strip.

The inventive hologram shown in Figs. 1a to 1c comprises a relatively thick, stable carrier film 10. Polyester films are preferably used. The carrier film bears a separation layer 12, for example a wax, that ensures easy removal of carrier film 10 from the rest of the compound material. Adjacent to separation layer 12 is transparent thin protective film 14 which is preferably made of PC, PVF, PETP, PCTFE or FEP. Such films are known for their excellent mechanical durability and dimensional stability. Protective film 14 bears an embossed layer 16 which consists for example of a known embossable lacquer. The embossed lacquer relief is customarily metalized. The metalizing is suggested in Figs. 1b and 1c by reference number 18.

The reflective metal layer may bear a protective layer 20 which is followed by an adhesive layer 22. Protective layer 20 can also be omitted; under certain circumstances it may suffice for sufficiently thick adhesive layer 22 to lie directly on embossed hologram 18.

If the adhesive layer is a contact adhesive, i.e. an adhesive that sticks in the cold state, the adhesive layer must be covered with a layer 24 to permit handling of the compound material. Silicone paper has proven particularly useful in this connection. If the layer is a hot-melt adhesive, such a paper layer is of course unnecessary since the hot-melt adhesive only develops its adhesive effect at higher temperatures.

Instead of embossed hologram 18 one can also provide a photosensitive layer into which the hologram is incorporated by exposure, i.e. a so-called volume hologram. Such photosensitive layers and their treatment are known; suitable materials are photopolymers or fine-grained photographic emulsions. The volume hologram is covered, not with a metal layer, but with a black backing layer of lacquer. It is also possible to color the already existing adhesive layer 22 black.

The production of a semifinished product according to Fig. 1a is shown schematically in Fig. 2. A separation layer (release layer) made of wax, for example, is applied at 28 to carrier film 10 unrolled from a drum 26. The inventive protective film runs from a film producing or unrolling means 30 to laminating means 32 in which the film is laminated to the carrier film by passing through a roll slit. Embossed layer 16 is then applied in unit 34. The compound material according to Fig. 1a is finally wound onto drum 36 and subsequently processed in the known way.

The further steps are the embossing of a hologram into embossed layer 16, the vacuum metalizing of embossed layer 16 before or after embossing, and then optionally the application of a protective layer 20. The adhesive, which may be a contact adhesive or a hot-melt adhesive, is then applied to the protective layer. If a contact adhesive is used the compound material is covered with silicone paper.

Fig. 3 shows the schematic diagram of an application sys-

tem for applying the holograms to an endless paper strip. The film compound material according to Fig. 1c is removed from drum 38, whereby silicone paper 24 is first detached from the compound material via drum 40. The paper to be provided with the hologram is supplied from drum 42 to a roller frame 44, whereupon the hologram is pressed with contact adhesive layer 22 onto the paper in a roll slit. The paper with the hologram adhering thereto is wound onto drum 46 while the carrier film is detached from the compound and runs to drum 48. In the case shown a continuous hologram strip or endless thread is transferred to the paper carrier.

It is of course likewise possible to work with the known hot transfer technique, i.e. to design adhesive layer 22 as a heat-sealing layer and emboss the hologram on by means of rolls or heated dies. This means that only the adhesive layer located directly below the roll or die softens and adheres to the substrate. Upon removal, all parts of the compound material are also removed which were located in areas not heated by the die.

When using islandlike labels it is of course necessary, regardless of the adhesive method used (hot-melt adhesive, contact adhesive, etc.), to accordingly prepunch thin protective film 14, which is a tear-resistant, stable material, since it is otherwise impossible to extract the hologram label from the film compound. Preferably, the optically variable elements adhering to the substrate are again pressed on to the substrate over the entire surface and optionally under the action of heat after removal of the non-prepunched areas

Further layers can of course also be present in the element in addition to the described layers, for example to provide protection from forgery. It is also conceivable to pretreat the paper carrier so as to improve adhesion of the smoothness of the transition. Such measures are e.g. the previous application of adhesive layers or bonding agents to the paper, or the preembossing or glazing of the paper in the areas where the hologram is to be disposed.

1. A multilayer optically variable transfer material having an adhesive layer (22), at least one layer (16, 18, 20) having the optically variable effect, at least one protective layer (14) and a removable carrier layer (10), characterized in that the protective layer (14) is designed as a self-supporting and dimensionally stable layer having a thickness of from a few micrometers to about 20 μ and is a plastic film being selected from the group consisting of polycarbonate (PC), polyvinyl fluoride (PVF), polyethylene terephthalate (PETP), polychlorotrifluoroethylene (PCTFE)and tetrafluoroethylene/hexafluoropropylene copolymer (FEP).

2. The optically variable transfer material as defined in claim 1 wherein the optically variable transfer material is a hologram.

3. The optically variable transfer material as defined in claim 1 or 2 wherein the adhesive layer (22) is covered by an easily removable cover layer (24).

4. The optically variable transfer material as defined in any one of claims 1, 2 and 3, characterized in that the layer with the optically variable effect consists of an embossed layer (16), a reflective metal layer (18) and a protective layer (20) that is adjacent to the adhesive layer (22).

5. The optically variable transfer material as defined in any one of claims 1, 2 and 3, characterized in that the layer with the optically variable effect consists of a photosensitive layer with a volume hologram and further consisting of a black backing layer covering the photosensitive layer and adjacent to the adhesive layer (22), the photosensitive layer being selected from the group

consisting of a photosensitive emulsion and a photosensitive polymer.

6. The optically variable transfer material of claim 5, characterized in that the black backing layer is formed of the adhesive layer (22).

7. The optically variable transfer element as defined in any one of claims 1 to 6, characterized in that the adhesive layer (22) is a layer of hot-melt adhesive.

8. The optically variable transfer material as defined in any one of claims 1 to 6, characterized in that the adhesive layer (22) is a layer of contact adhesive.

9. The optically variable transfer material as defined in any one of claims 1 to 8, characterized in that contours of an element to be transferred to a substrate are punched out or prepunched in the protective layer (14).

10. The optically variable transfer material as defined in any one of claims 1 to 8, characterized in that it is present in the form of one selected from the group of an endless, reelable thread and an endless reelable strip.

11. A substrate with the optically variable transfer material as defined in any one of claims 1 to 10 glued thereto.

12. The substrate of claim 11, characterized in that it is a paper of value.

13. The substrate of claim 12, characterized in that the paper of value is a bank note.

14. The substrate of claim 12 or 13, characterized in that the optically variable transfer material is glued to the paper of value in the form of a thread running from edge to edge.

15. A method for producing an optically variable transfer material, characterized by the following steps:

a) applying a separation layer (12)to a long-wearing and machinable carrier film (10),

b) applying a transparent, self-supporting, dimensionally stable protective film (14) with a thickness of from a few micrometers to about 20 μ to the separation layer (12), the protective film (14) consisting of a plastic film being selected from the group consisting of polycarbonate (PC), polyvinyl fluoride (PVF), polyethylene terephthalate (PETP), polychlorotrifluoroethylene (PCTFE) and tetrafluoroethylene/hexafluoropropylene copolymer (FEP),

c) coating the film (14) with an embossable layer of lacquer (16),

d) embossing a hologram into the layer of lacquer,

e) metalizing the embossed layer of lacquer with a thin reflective metal layer (18),

f) applying a protective layer (20) covering the metal layer (18), and

g) applying an adhesive layer (22).

16. A method for producing an optically variable transfer material, characterized by the following steps:

a) applying a separation layer (12) to a long-wearing and machinable carrier file (10),

b) applying a transparent, self-supporting, dimensionally stable protective film (14) with a thickness of from a few micrometers to about 20 μ to the separation layer (12), the protective film (14) consisting of a plastic film being selected from the group consisting of polycarbonate (PC), polyvinyl fluoride (PVF), polyethylene terephthalate (PETP), polychlorotrifluoroethylene (PCTFE) and tetrafluoroethylene/hexafluoropropylene copolymer (FEP),

c) coating the film (14) with one selected from the group consisting of a photographic emulsion and a photopolymer,

d) incorporating a volume hologram into the one selected from the group consisting of the emulsion and the photopolymer by appropriate exposure steps,

e) covering the one selected from the group consisting of the emulsion and the polymer with a black backing layer, and

f) applying an adhesive layer (22).

17. The method as defined in claim 15 wherein the optically variable transfer material is a hologram.

18. The method as defined in claim 15 or 17, characterized in that the separation layer (12) is a detachable adhesive layer.

19. The method as defined in any one of claims 15, 17 and 18, characterized in applying a detachable protective layer (24).

20. The method as defined in claim 16, characterized in that the optically variable transfer material is a hologram.

21. The method as defined in claim 16 or 20, characterized in that the separation layer (12) is a detachable adhesive layer.

22. The method as defined in any one of claims 16, 20 and 21, characterized in applying a detachable protective layer (24).

23. The method as defined in any one of claims 16 and 20 to 22, characterized in that the adhesive layer is colored black.

24. The method as defined in any one of claims 15 to 23, characterized in that the adhesive layer (22) consists of contact adhesive that is covered by an easily removable cover layer (24).

25. The method as defined in claim 24 characterized in that the easily removable cover layer (24) is silicone paper.

26. The method as defined in any one of claims 15 to 25, characterized in that contours of an element to be transferred to a substrate are prepunches in the protective film (14).

27. The method as defined in any one of claims 15 to 23 and 25, characterized in that the adhesive layer (22) comprises a hot-melt adhesive.

28. The method of any one of claims 15, 16, 23, 24, 26 and 27, characterized in that the optically variable transfer material is cut into narrow endless threads and wound up.

29. A method for applying an optically variable element using the transfer material of claim 10 to a substrate, characterized in that the one selected from the group consisting of the thread and the strip is wound off a supply reel (38), the one selected from the group consisting of the thread and the strip is brought together in a roll slit with a substrate, the one selected from the group consisting of the thread and the strip sticks with its adhesive layer to the substrate, and the carrier film (10) is simultaneously removed from the one selected from the group consisting of the thread and the strip upon leaving the roll slit.

30. A method for applying an optically variable element using the transfer material of claim 9 to a substrate, characterized in that the substrate and a flat piece of the optically variable transfer material with the prepunched area are placed together, the prepunched contour is subjected to a die, and the flat piece is removed from the substrate, the prepunched area of the transfer material sticking to the substrate as an optically variable element.

31. The method as defined in claim 30, characterized in that the die is heated.

32. The method of claim 30 or 31, characterized in that the optically variable element adhering to the substrate is again pressed onto the substrate over the entire surface.

33. The method as defined in claim 24,characterized in that the easily removable cover layer (24) is removed.

34. The method as defined in claim 29 or 33, characterized in that the substrate is a continuously supplied paper of value.

35. The method as defined in claim 32, characterized in that the optically variable element adhering to the substrate is pressed onto the substrate under the action of heat after removal of the non-prepunched areas.

FIG.1a

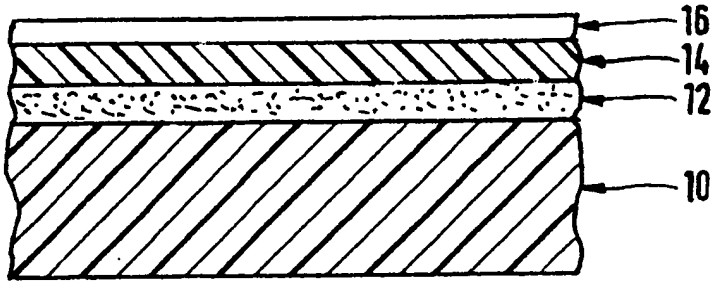


FIG.1b

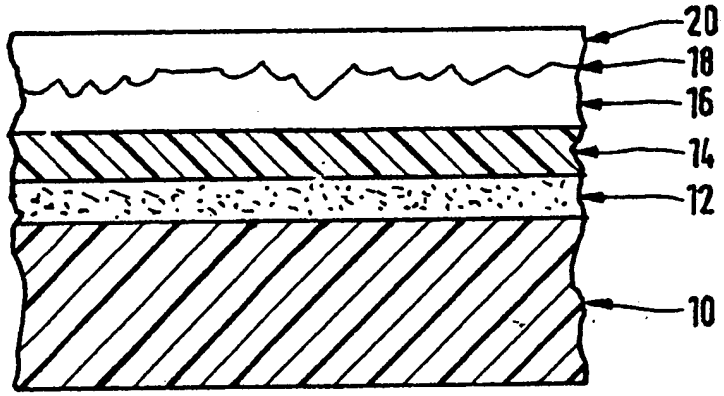
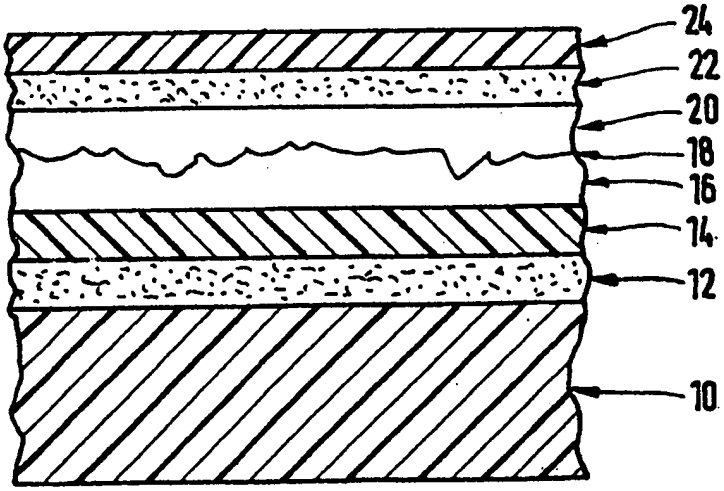


FIG.1c



Kirkus McKenzie & Herbert

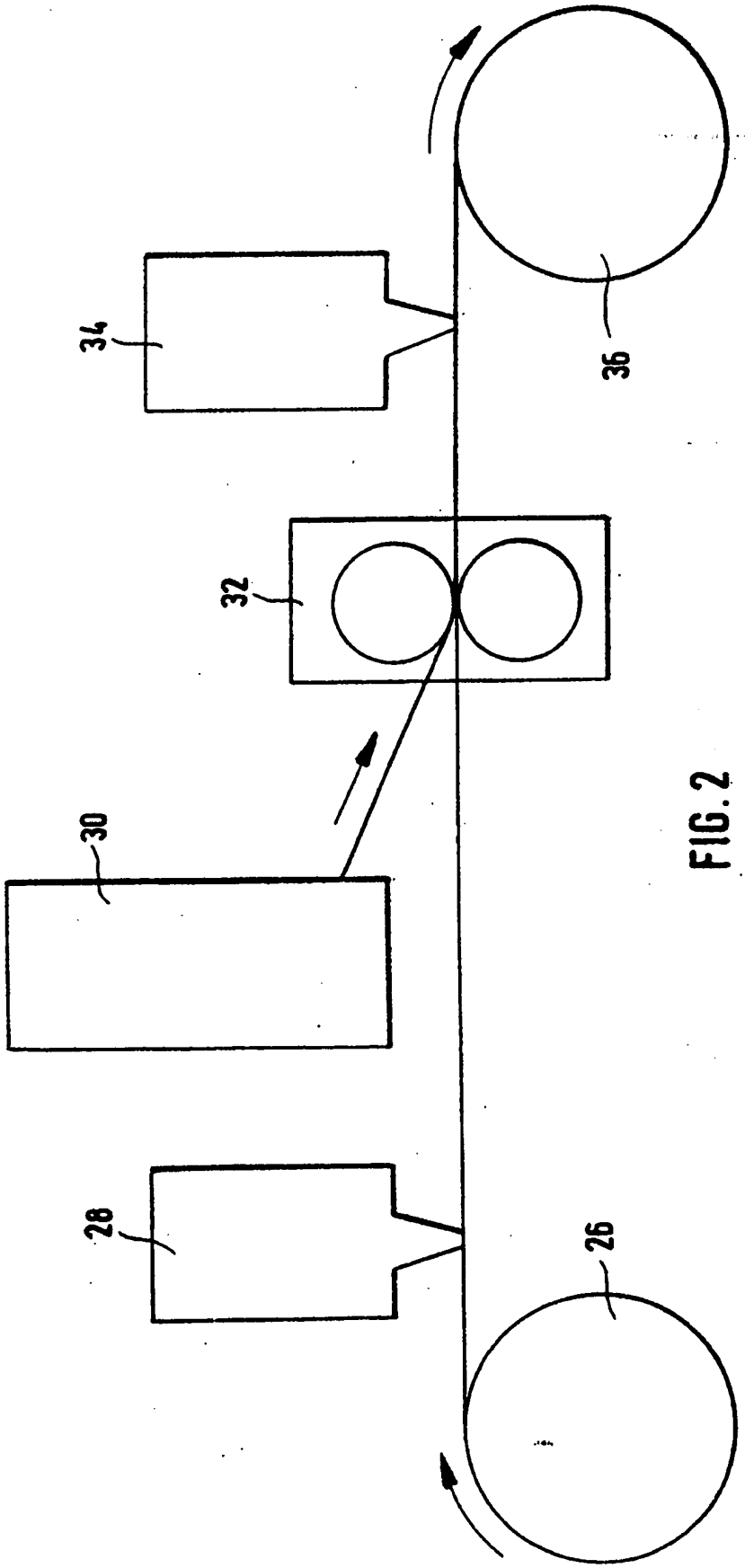


FIG. 2

Richies McKenzie & Herbert

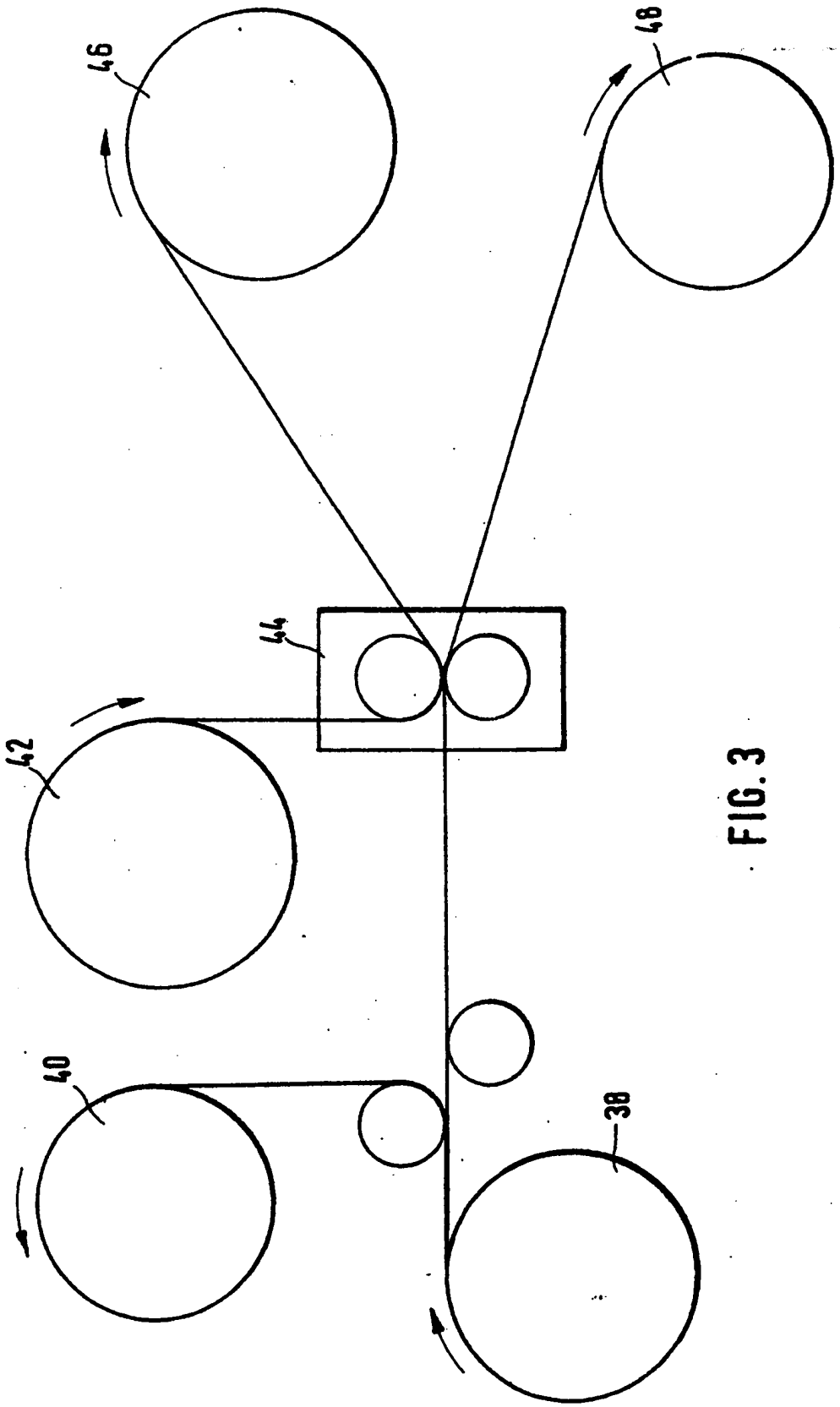


FIG. 3

Riches McKenzie & Herbert